U.S. Department of Transportation

Federal Aviation Administration

Memorandum

Subject:	Action: Review and Concurrence, Equivalent Level of Safety Finding for the Embraer Model ERJ-170 FAA Project Number TC00561B-T	Date:	June 9, 2003
		Reg Ref:	§ 25.331(c)
From:	Manager, TSS Airframe/Cabin Safety Branch, ANM-115	Reply to Attn of:	Hank Offermann ANM-115
To:	Manager, International Branch, ANM-116	ELOS Memo #:	TC00561B-T-HES-13

Background

Section (§) 25.331(c) of Title 14, Code of Federal Regulations, part 25 (FAR 25), prescribes a checked pitching maneuver in which the cockpit pitch control is first displaced in a nose up direction, then the control is displaced in the opposite direction sufficient to "check" the pitching motion. The control displacements must develop specified nose up and nose down pitching accelerations. The magnitude of these control inputs must be such that the positive limit maneuvering load factor prescribed in § 25.337 is achieved on the airplane, but not exceeded.

The current regulations prescribe pitching accelerations without any accounting for the size, configuration or characteristics of the airplane. In fact, the same pitching accelerations are applied to the smallest personal transport airplanes as to the largest air carrier transports. The corresponding requirement in the European Joint Aviation Regulations (JAR) for Large Aeroplanes, JAR-25, is similar, however, there are no specific minimum pitching accelerations that must be achieved. Rather, JAR-25 paragraph 25.331(c)(2) requires a rational motion. This rational motion is not defined in the rule but the associated advisory material, Advisory Circular Joint (ACJ) 25.331(c)(2), prescribes a control motion in the form of a sine wave. The prescribed control input relates the frequency of the control motion to the frequency of the short-period rigid body mode of the airplane, thereby accounting for the characteristics of the particular airplane. The short-period rigid body mode is one of the two longitudinal stability modes that are inherent in every airplane and identified during the design phase.

Neither FAR 25 nor JAR-25 provides adequate criteria to fully account for the characteristics of advanced electronic flight control systems in which the achievable maneuvering load factors are governed by special computer control laws.

A new proposed § 25.331(c), maintaining the present § 25.331(c)(1) and revising the present § 25.331(c)(2), has been submitted for publication as a Notice of Proposed Rulemaking (NPRM). The NPRM is based on a harmonized recommendation received by the FAA from the Aviation Rulemaking Advisory Committee (ARAC) that addressed the undesirable aspects of both the FAR and JAR rules.

Applicable regulation(s)
§ 25.331(c)

Regulation(s) requiring an ELOS
§ 25.331(c)(2)

Description of compensating design features or alternative standards that allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)
The proposed rule, submitted by ARAC and forwarded for publication as an NPRM, maintains the principles of the existing rule, but removes the arbitrary application of a single prescribed criteria that could be more or less severe than the actual checked pitch maneuver when performed for a particular airplane. The new proposed rule adds specific requirements that tailor the application of the rule to airplane characteristics that are aggravating with regard to the development of maneuver loads. The effects of automatic or advanced electronic flight control systems, where achievable maneuvering load factors are governed by computer control law, are considered.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation
The new proposed § 25.331(c) specifically addresses the characteristics of individual airplanes by forcing the maneuvers to be performed at critical longitudinal stability modes while maintaining the maneuver load boundary conditions of the present rule.

FAA approval and documentation of the ELOS
The FAA has approved the aforementioned Equivalent Level of Safety Finding as documented in Centro Técnico Aeroespacial Ficha de Controle Assuntos Relevantes HES-13. This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The Transport Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the Type Certificate Data Sheet under the Certification Basis section. [E.g., Equivalent Safety Findings have been made for the following regulation(s):

§ 25.331 (c)(2) Pitch Maneuver Conditions (documented in TAD ELOS Memo TC00561B-T-HES-13)]

original signed by Franklin Tiangsing — *11 June 2003*

Manager, Transport Standards Staff, Airframe/Cabin Safety Branch, ANM-115 — Date

ELOS Originated by: Standards Staff, Airframe /Cabin Safety Branch	Project Engineer Hank Offermann	Routing Symbol ANM-115